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U.S. PATENT AND TRADEMARK OFFICE
PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 C.F.R. §1.53(b)(2)

Atty. Docket. ALPERT 2

INVENTOR(S)/APPLICANT(S)			
LAST NAME	FIRST NAME	MI	RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY
ALPERT	Ortal		Jerusalem, Israel
EYTAN	Ori		Jerusalem, Israel
WASSERMAN	Thierry		Tel Aviv, Israel

[ ] Additional inventors are being named on separately numbered sheets attached hereto

TITLE OF THE INVENTION (280 characters max)

METHOD AND SYSTEM FOR TIGHT FOCUSING OF OPTICAL READING OR RECORDING BEAN INSIDE MONOLITHIC STORAGE MATERIAL

CORRESPONDENCE ADDRESS

Direct all correspondence to the address associated with Customer Number 001444, which is presently

BROWDY AND NEIMARK, P.L.L.C.
624 Ninth Street, N.W., Suite 300
Washington, D C 20001-5303

ENCLOSED APPLICATION PARTS (check all that apply)

[X] Specification — Number of Pages 4 — [X] Applicant claims small entity status. See 37 C.F.R. §1.27

[X] Drawing(s) — Number of Sheets 1 — [ ] Other (specify) _____

METHOD OF PAYMENT (check one)

[X] Credit Card Payment Form PTO-2038 is enclosed to cover the Provisional filing fee of

[ ] $160 large entity [X] $80 small entity

[X] The Commissioner is hereby authorized to charge filing fees and credit Deposit Account Number 02-4035

The invention was made by an agency of the United Stated Government or under a contract with an agency of the United States Government

[X] No [ ] Yes, the name of the U S Government agency and the Government contract number are

Respectfully submitted,

BROWDY AND NEIMARK, PLLC

By: _____
Jay M. Finkelstein
Registration No.: 21,082

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Tight Focusing of Optical Reading or Recording Beam inside Monolithic Volumetric Storage Material

The invention relates to a method of focusing a laser beam within a three-dimensional storage material at various depths while keeping the beam spatial characteristics. Optical storage devices have customarily been dependent on the ability to focus a laser beam to a tight spot on the order of its diffraction limit so as to allow for the squeezing of as much information as possible onto the surface of the optical disk. It is therefore of paramount importance to be able to correct for all optical aberrations so as to achieve this. The spherical aberration of a particular optical setup is dependent on the nature of the material the light traverses and the length of the path through it. Optical storage devices have customarily stored data within a particular and well known depth of transparent material. It has therefore been straightforward to design an optical setup that would correct for spherical aberration appropriate to the particular depth standard for a particular device. Designing a volumetric storage system that stores information within the volume of a monolithic material, the varying spherical aberration needs to be taken into account and corrected for so as to allow focusing of the laser beam to a near diffraction limited focus.

The purpose of the invention is the correcting of the spherical aberration for the varying depth of focus of such a device within the volume of a monolithic translucent material. It is assumed that the optical beam of light after passing through a lens will traverse two distinct materials (usually air followed by a clear plastic but not necessarily so) and focus within the second material. The correction of the spherical aberration can be achieved by the addition of extra optical elements (the corrector), such as lenses but not restricted to these, placed before the focusing lens within the optical path of the laser beams that can be adjusted so as to compensate for the changing depth of focus within the material. The correction of

the spherical aberration is attained by varying the position of the optical elements within the corrector as the depth of focus within the material is altered.

The monolithic nature of the storage material entails a uniformity of the disk; results in a homogeneous index of refraction and absorption coefficient throughout the disk. This allows for the designing of an aberration corrector whose range of motion and overall behavior is well known. The movement of the relevant parts within the corrector can be done, for instance, in one of the following ways:

(i) Mechanically in conjunction with the movement of the focusing lens designed according the predicted behavior of the spherical aberration.

(ii) Using a motor according to the predicted behavior of the spherical aberration.

(iii) Using a feedback mechanism from a detector sensitive to the tightness of the focus of the reading or writing laser beams to move the optical elements within the corrector using a motor.

(iv) Using a feedback mechanism taking to the signal emerging from the storage medium as input so as to move the optical elements within the corrector using a motor.

A particular corrector will be designed taking into account the nature of the storage material, the range of motion necessary, the wavelength of light in use and the focusing lens used. Such a device can be designed so as to accommodate more than one wavelength of light.

Description of figure

The schema consists of three main parts: (i) the emission/detection part, (ii) the optical focusing and aberration correction part, (iii) the disk

(i) The first part enables the parallel emission of the read optical beam and the write optical beam and the detection of signals from the disk without any mutual interference between the three.

(ii) The second part enables the correction of the spherical aberrations and the tight focusing of the different beams into the disk, and the efficient collection of signals from the disk. Two moving parts required: one in the correction mechanism and a second on the objective lens.

(iii) The disk is a monolithic piece of substrate (that may or may not be coated with a protective layer) with uniform index of refraction throughout and of excellent optical quality.

Comments

1. The disk. The storage media that may be of various form factors as well as long as it is composed of a monolithic substrate.
2. The disk may or may not be coated, e.g. for protection against UV radiation.
3 The disk may or may not be protected within a cartridge
4. A layer is one logical unit of data inscribed at a specific depth (within a specified tolerance)
5 Layers with very tight depth tolerance can be considered as having fixed depth.
6. Layers with loose depth tolerances will be termed as layers with variable depth.

7. The invention relates to the dynamic focusing of the beam in a large number of layers with *fixed* depths.
8. The invention relates to the dynamic focusing of the beam in a large number of layers of *variable* depth.
9. Data is written in a specified layer by changing the state of the substrate within a localized volume element, defined by the focus of the read/write/erase optical beams.
10. Though not detailed in the particular implementation, the device may include an erase optical beam in addition to the read and write optical beams.
11. An optical beam (either read, write or erase) may comprise the laser light from more than one diode and consequently have more than one wavelength.

Tight Focusing of Optical Reading or Recording Beam inside Monolithic Volumetric Storage Material

Figure 1. Optical Pickup Unit